

The RAND Corporation  
1700 Main Street  
Santa Monica, California

QUARTERLY STATUS REPORT

12 September 1963 - 11 December 1963

Task Order Contract NASr-21(07)

(Principal Investigator: Y. H. Katz)

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**UNPUBLISHED PRELIMINARY DATA**

RAND work under this Task Order Contract comprises basic studies relating to the scientific utilization of meteorological satellite data and the implications of new techniques and measurements to meteorological satellite development.

Description of Progress

1. Our research in pattern recognition has been aimed at developing some mechanical procedure for automatically recognizing and classifying cloud patterns with an ability comparable to that demonstrated by a consensus of trained meteorologists. In the first, or data reduction stage, tests are now being made and features which appear to be significant are being extracted in small collections of data. In the second, or decision process stage, the reduced data will become the arguments of a set of decision functions whose values will be used to provide our guess at an unknown pattern's identity.

In addition to generating the two-dimensional autocorrelation functions for patterns containing cloud streets and individual cumulus cells, we have obtained brightness distributions and have noted a possible class distinction based on these distributions.

Another motion invariant datum that may prove useful is being investigated. For each pattern sample, we allow white (cloud) to overrun black (space), or black to overrun white. Beginning at  $t = 0$ , a wave starts moving at constant speed in all directions, but advancing only into regions not already overrun. At each instant  $t$ , the area of cloudiness,  $a(t)$  is noted. Where white devours black, information relating to the distribution of widths of cloud-free spaces may be derived; where we allow black to devour white,  $a(t)$  should give us some information about the distribution of cloud sizes.

The first report on our research in pattern recognition will be forwarded to NASA during the next quarter.

OTS PRICE

XEROX

\$

1.10 *ph*

MICROFILM

\$

0.80 *inf.*

2. The first of a series of research reports relating to our survey of the electromagnetic spectrum, and covering the middle ultraviolet and vacuum ultraviolet portion of the spectrum, has been completed. It will be forwarded to NASA during the next quarter.

Another study (in preparation) will report on the feasibility of determining high-altitude water vapor from a satellite, by examination of the profile of the 1.35 cm water-vapor line in emission over land and sea surfaces as well as over a perfect reflector.

#### Problems Impeding Progress

No serious problems were encountered.

#### Future Work

In addition to continuing the studies described in items 1 and 2 above, we will be initiating a survey of recent trends and current progress in automatic pattern recognition. We will not attempt to present a comprehensive and systematic review of the background in this field; rather, we will endeavor to determine its possible future operational and research role in meteorological satellite activities and point out those aspects of pattern recognition work that may be applicable to future developments of a meteorological satellite system.

#### Reports

1. RM-3412-NASA, Automatic Pattern Recognition of Meteorological Satellite Cloud Photography, W. L. Doyle, Y. H. Katz (will be sent to NASA during next quarter).

2. RM-3950-NASA, Ultraviolet Spectroscopy of the Upper Atmosphere (Part I of an Examination of the Application to Satellite Meteorology of Various Segments of the Electromagnetic Spectrum), R. O. Hundley (will be sent to NASA during next quarter).

3. RM-3986-NASA, The Satellite Determination of High-Altitude Water Vapor, E. C. May and A. B. Kahle (in preparation).

#### Personnel

The following scientific personnel were active during the reporting period: M. H. Davis, W. L. Doyle, R. O. Hundley, A. B. Kahle, Y. H. Katz, W. W. Kellogg, E. C. May (consultant), Y. Mintz (consultant), K. J. K. Buettner (consultant).